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The Structure of Fats and Fatty Acid Consumption in Elderly People with Cardiovascular System Diseases

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A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article

Abstract

Background. Patients with cardiovascular system diseases having their origin in arteriosclerosis require special dietetic treatment. Among many nutritional components, fats in the diet (both their quantity and quality) play a very important role in primary and secondary prevention of these diseases.
Objectives. The aim of the study was the estimation of total fats participation (saturated fatty acids, mono- and polyunsaturated fatty acids and cholesterol) in the Daily Nutritional Ration (DNR) of elderly people with cardiovascular system diseases.
Material and Methods. The study included 128 persons (66 women and 62 men, mean age 73.2 ± 6.9) hospitalized in the 1st Clinic of Cardiology and Hypertension, UJCM in Kraków. Daily intakes of energy were estimated using the 24-h nutritional recall and Food Frequency Questionnaire.
Results. A higher consumption of fats and fatty acids was observed in men's diet than in women's diet. The percentage of energy from saturated fatty acids (10.6% M and W) was higher than dietary recommendations. The consumption of monounsaturated fatty acids was in accordance with nutritional recommendations. The participation in the diet of polyunsaturated fatty acids was insufficient versus the newest nutritional recommendations and was determined as 4.6% of energy in DNR in men and 4.1% of energy of DNR in women.
Conclusions. The excessive amount of saturated fatty acids together with the insufficient amount of polyunsaturated fatty acids in the diet are the result of the excessive consumption of products which are a source of animal fat and insufficient consumption of plant fat, fish and seafood (**Adv Clin Exp Med 2016, 25, 1, 69–75**).

Key words: fatty acids, elderly people, fat total, cardiovascular system diseases.

A proper nutrition is one of the main factors determining health status. Among elderly people there is a natural increase of the risk of diet-dependent chronic degenerative diseases, which is why proper nutrition is a very important element of lifestyle. Both shortages of nutritional components and their overuse may accelerate ageing and stimulate the development of degenerative diseases, influencing the quality and the length of life of elderly people. Improper nutrition is one of the factors predisposing a person to cardiovascular diseases and a change of nutritional habits plays a very important role in the primary and secondary prevention of these diseases. Cardiovascular diseases having their origin in arteriosclerosis require specialized dietetic treatment. Among the many nutritional components necessary for the proper function of the human body and playing a very important role in the pathogenesis of arteriosclerosis, the participation of fats (amount and quality) in the diet is crucial [1–3].

The research estimating the influence of fats on the human body have shown that not the amount but the sort and content of fatty acids from the diet have the most important influence on the development of diseases such as arteriosclerosis, ischemic heart disease and neoplastic diseases. Animal fats, rich in saturated fatty acids and cholesterol, have a particularly bad influence on the human body. A strong connection was found between

the excessive participation of saturated fatty acids in the diet and an increased concentration of total cholesterol and LDL fraction in the blood and the occurrence of ischemic heart disease. A positive effect is observed in the case of unsaturated fatty acids omega 3 and 6. They act against arteriosclerosis, inflammatory processes against platelet aggregation.

For ensuring the body has the proper level of omega 3 acid reactions and the possibility of good health, changes in the participation of omega 3 and 6 acids in the Daily Nutritional Ration (DNR) are important [2–5]. According to the Polish Forum of Cardiovascular Disease Prophylactic Program, the proportion of omega-6 to omega-3 acids should be 4 : 1 [6]. Both the shortage and over-use of fatty acids may be harmful to the human body. Nevertheless, the reduction of saturated fatty acid consumption and increase of polyunsaturated fatty acid consumption is the most efficient method for the normalization of the lipid value in the blood [3–5].

The aim of this study was the estimation of the consumption of all fats: saturated, mono-saturated and polyunsaturated, and cholesterol by persons who are older than 60 years with confirmed diseases of the cardiovascular system. Moreover, the frequency of consumption of products as a source of fats in the diet of the examined people was analyzed.

Material and Methods

The study included 128 persons (66 women and 62 men) aged more than 60 (mean age: 73.2 ± 6.9) hospitalized in the 1st Clinic of Cardiology and Hypertension, UJCM in Kraków. The most important inclusion criteria for these particular people were a confirmed disease of the cardiovascular system and the absence of diseases influencing nutritional status and metabolism. All the examined persons gave written consent to the participation in the study. The study obtained the approval of the Ethics Committee for Human Research of Jagiellonian University, Medical College.

The estimation of the nutritional status was done on the basis of a 24-h nutritional recall preceding the examination and the Food Frequency Questionnaire (FFQ).

The interview was conducted according to widely accepted methods and recommendations concerning the examination techniques on the subject of nutrition. While gathering for the interview, photos of food products published in "Album photos of portions of Products and Meals" of the Institute of Food and Nutrition [7] were presented to respondents. The data gathered underwent an amount analysis that included calculation of the energetic value of DNR together with a percentage share of the energy coming from proteins, fats, carbohydrates and the content of nutritional components such as total fats, fatty acids with the division into saturated fatty acids (SFA), mono saturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) and cholesterol. The calculations were done using the Diet-Pro program for 24-h nutritional recall analysis. The results calculated individually for each person were compared to nutritional norms, published by the Institute of Food and Nutrition in Warsaw [4], recommendations of the Polish Forum of the Prophylactics of Cardiovascular Diseases [6], Healthy Diet according to Polish Cardiology 2012 [8] and recommendations of the European Food Safety Authority (EFSA) [9].

The consumption frequency corresponded to one month preceding the examination. The FFQ questionnaire included 20 nutritional products treated as a main source of fats. The frequency of consumption was estimated on the basis of 7 categories (range) such as: 1 (I do not eat at all), 2 (I eat once a month), 3 (I eat 2–3 times a month), 4 (I eat once a week), 5 (I eat 2–3 times a week), 6 (I eat 4–6 times a week), 7 (I eat every day). For a proper interpretation of average ranges of the frequency of consumption for each nutritional product, the following ranges were used: 1–1.49 – not consumed at all; 1.5–2.49 – consumed once a month; 2.5–3.49 – consumed 2–3 times a month; 3.5–4.49 – consumed once a month; 4.5–5.49 – consumed 2–3 times a week; 5.5–6.49 – consumed 4–6 times a week; 6.5–7 – every day. Statistical analysis of the results was performed using the STATISTICA 6.0 program (Mann-Whitney test was used, level of confidence $p < 0.05$).

Results

The energetic value of the analyzed DNR was too low (for age, gender, body mass and low level of physical activity) and covered 70% of the recommended value. The percentage of energy coming from carbohydrates and fats in the total energy of the diet was in accordance with nutritional recommendations and the percent of proteins in the general energetic value of the diet slightly over recommendations (M:16% of energy, W:15.5% of energy) (Table 1).

The consumption of fats and fatty acids contained in the DNR was statistically significantly higher among men than women (Table 2). While analyzing the structure of fatty acid consumption, it can be stated that the consumption of SFA was on the level of 17.39 g/day in men and 15.88 g/day

Table 1. The percentage participation of proteins, carbohydrates and fats in the energetic value of DNR in the studied participants

Ingredient	Men			Women		
	[kcal]	recommended intake	[%]	[kcal]	recommended intake	[%]
Energy value	1471.54	2100 kcal*	–	1346.86	1900 kcal*	–
Carbohydrates	783.6	50–75%*	53.3	742.76	50–75%*	55.13
Protein	235.96	10–15%*	16.0	208.8	10–15%*	15.53
Fat	451.98	< 30%***	30.7	395.28	< 30%***	29.34
Saturated fatty acids	156.51	< 10%** < 7%***	10.6	142.92	< 10%** < 7%***	10.6
Monounsaturated fatty acids	184.95	< 20%***	12.6	157.86	< 20%***	11.7
Polyunsaturated fatty acids linoleic acid, n-6 alfa-linoleic acid, n-3	68.31 49.68 1.67	6–10%*** 4%**** 0.5%****	4.6 3.37 0.99	56.1 41.04 12.51	6–10%*** 4%**** 0.5%****	4.1 3.04 0.92

* – recommendations of the norms of human nutrition [4]; ** – recommendations of healthy diet according to Polish cardiology 2012 [8]; *** – recommendations of the Polish Forum of Circulation System Disease Prophylaxis [6]; **** – recommendations of the European Food Safety Authority (EFSA) [9].

Table 2. Intake of fats and fatty acids in DNR by elderly people

Ingredient	Men		Women		p
	X	SD	X	SD	
Total fat [g]	50.22	18.11	43.92	29.35	0.004
Saturated fatty acids [g]	17.39	7.21	15.88	11.07	0.01
Monounsaturated fatty acids [g]	20.55	8.72	17.54	12.91	0.003
Polyunsaturated fatty acids [g]	7.59	3.61	6.23	4.58	0.04
Cholesterol [mg]	235.71	166.34	239.99	229.04	0.07

in women, which was 10.6% of the energy of the DNR among representatives of both sexes. These values were higher than nutritional recommendations, according to which SFA should supply no more than 10% of the energy included in meals, and in people with increased risk of cardiovascular system diseases, should even supply less than 7% of the energy [4, 6, 8].

The consumption of monounsaturated fatty acids was in accordance with nutritional recommendations and delivered 12.6% of the energetic value of the DNR in men and 11.7% in women. The share of polyunsaturated fatty acids in the respondents' diets from both groups was not sufficient (4.6% energy of DNR in men and 4.1% energy of DNR in women) compared to nutritional recommendations. Linoleic acid (omega-6) delivered 3.37% of the energetic value of the DNR in men and 3.04% in the women's group. These values were not sufficient when we take into consideration the latest EFSA nutritional recommendations [9], according to which, a well-balanced diet should supply 4% of the energy from linoleic acid (LA) and 0.5% of energy from alfa-linoleic acid (ALA.) The proportion of alfa-linoleic acid exceeded recommendations and delivered nearly 1% of the energetic value of DNR in both groups (Table 1, 2). The amount of cholesterol slightly exceeded nutritional recommendations for people with lipid disturbances. According to these recommendations it should be no more than 200 mg of cholesterol/day in a well-balanced diet [6] (Table 2).

The quantity structure of saturated fatty acid consumption in the daily diets of the examined men was similar to the women's group. Among the SFA consumed by men (17.39 g), nearly half (8.93 g) was palmitic acid (C16:0). Among women, the consumption of palmitic (C16:0) acid was also the highest and was assessed as nearly half of (7.98 g) the total amount of SFA (15.88 g). Although in smaller amounts, stearic acid (C 18:0) (3.89 g M; 3.62 gW), miristic acid (C14:0) (2.02 gM; 1.91 gW)

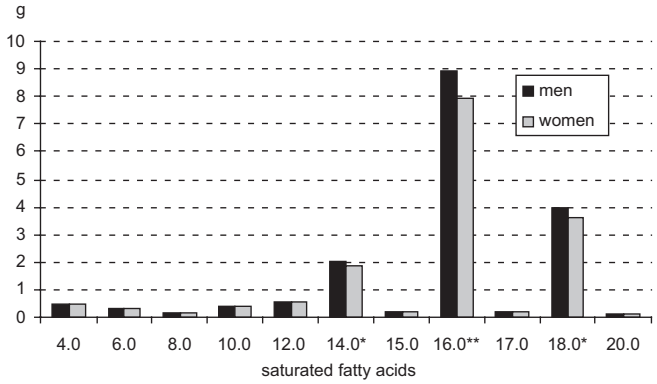

Fig. 1. The contribution of chosen fatty acids in grams in general consumption of SFA

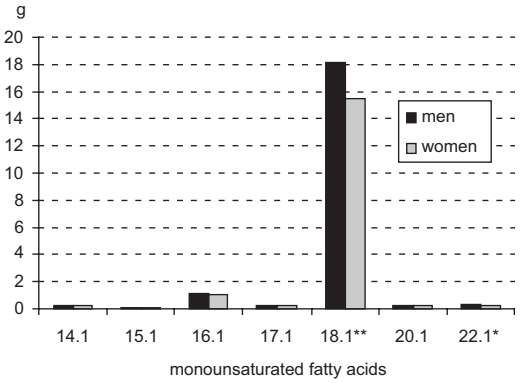

Fig. 2. The contribution of some fatty acids in general supply of MUFA

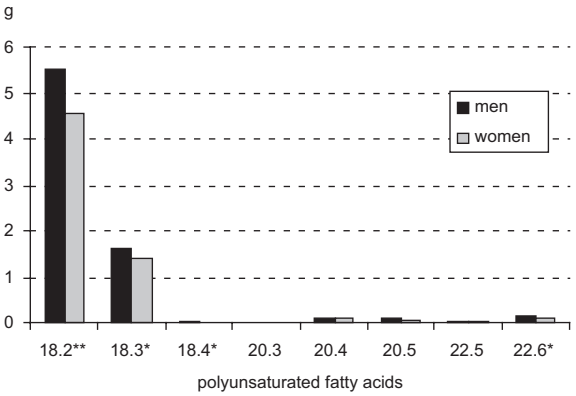

Fig. 3. The contribution of particular fatty acids in general supply of PUFA

and lauric acid were consumed (C:12) (0.55 gM and W). The consumption of other saturated fatty acids was marginal (Fig. 1).

While analyzing the structure of consumption of monounsaturated fatty acids, it can be stated that oleic acid constituted 90% among both women and men (C18:1). The content of palmitic acid (C16;1) in the DNR was 1.22 g in men and 1.10 g in women (Fig. 2).

Among the polyunsaturated fatty acids included in the DNR, (Table 2), linoleic acid was consumed the most frequently (C18:2 n-6). The participation of linoleic acid in the men's diet (5.52 g) was much higher, and was statistically significant, in comparison to the women's diet (4.56 g). Alfa-linoleic acid (C18:3 n-3) was also consumed more often by men (1.63 g) than by women (1.39 g) with statistical significance. The consumption of other acids from these groups was very low (Fig. 3).

The analysis of the Food Frequency Questionnaire allows us to find the main sources of fat, with milk and milk drinks, cottage cheese, chicken and plant oils usually consumed 2–3 times a week. Men preferred butter consumption (4–6 times a week) more than women (2–3 times a week). Eggs were eaten once a week, and beef, pork and yellow cheeses 2–3 times a month. Low or no consumption of fish (once a month), seafood and seeds of oily plants and nuts (not eaten at all), which are rich in polyunsaturated fatty acids, were equal among both sexes (Table 3).

Discussion

In the analyzed DNR, the participation of fats was at the level of 30.7% of energy in the men's and 29.3% of women's diet, which was on the upper border level versus actual nutritional recommendations [4]. In both groups, an excessive share of energy (10.6% DNR) coming from SFA was stated. This amount of fatty acids was higher than the nutritional recommendations for people with a high risk of cardiovascular system diseases [4, 7]. The results were similar to data coming from the National Examination of Health Status of Citizens of Poland (WOBASZ) [10]. There it was described that SFA in men's diet supplied 13.5% of the energy of the DNR and in women 12.7% of the energy. Anyżewska's et al. [11] research estimating the participation of fats in the diet of persons with cardiovascular system diseases showed that fat delivered 36% of the energetic value of the DNR and SFA consumption was 11 g/day. Suliburska's et al. [12] research describing the course of nutrition of Polish people with hypertension from urban and rural areas of the Wielkopolska region showed an excessive percentage share of energy value from fats

Table 3. The characteristics of nutritional products being a source of fats presented in the ranges of the consumption frequency together with the gender division

Men	**Women**
Interval 6.5–7 – products consumed every day	
Interval 5.5–6.49 – products consumed 4–6 times a week	
butter	
Interval 4.5–5.49 – products consumed 2–3 times a week	
milk and milky drinks; cottage cheese; poultry	milk and milky drinks; *sour milk;* cottage cheese; poultry; *butter*
Interval 3.5–4.49 – products consumed once a week	
sour milk; eggs; butter with oils; plant oils	eggs; butter with oils; *olive oil*; plant oils
Interval 2.5–3.49 – products consumed 2–3 times a month	
hard cheese; beef; pork	hard cheese; beef; pork; *soft margarines*
Interval 1.5–2.49 – products consumed once a month	
giblets; non-fatty fish; fatty fish; pork fat; *olive oil; soft margarines;* hard margarines	giblets; non-fatty fish; fatty fish; pork fat; hard margarines
Interval 1–1.49 – not consumed at all	
seafood; nuts; the seeds of oily plants	seafood; nuts; the seeds of oily plants

Text written in normal type – products consumed by both men and women; text written in *italics* – products consumed by men or by women.

(39.1% fat in urban areas and 34.3% in rural areas). Similar data was gathered by Przysławski et al. [13], describing 34% of the energy from total fats, including energy coming from SFA (12.9%), in the diet of obese women and with confirmed hypercholesterolemia. Other studies in Poland have also shown an excessive share of total fat and SFA in the diet of elderly people [11, 14–17]. In the analyzed DNR, palmitic acid (C16:0) was the most dominant and accounted for nearly half of the total amount of SFA in the diet of women and men. A significant percentage share of stearic acid, miristic acid (C14:0) and lauric acid was also observed (C12:0). The content of the above-mentioned fatty acids compared to DNR guidelines was higher in the men's than in the women's group and the difference was statistically significant. Laurynic acid, mirystynoic acid and palmitic acid (being 66% of the total content of SFA in men's and women's diet) belong to the group of fatty acids with pro atherosclerotic activity. This activity increases total cholesterol concentration and LDL fraction in blood serum [4, 18]. Similarly excessive consumption of SFA, having aterogenic consequences in a population of elderly people, was shown in Wolanska's et al. research [18].

The results presented show that MUFA supplied more energy (12.6% in men and 11.7% in women), according to DNR norms, than SFA, which from a nutritional point of view is considered to be beneficial. Similar results concerning the participation of MUFA and SFA were presented in Anyżewska's et al. research [11]. The results of many studies prove that MUFA lowers the concentration of total cholesterol and LDL and increases the level of HDL cholesterol [3, 19]. Among MUFAs, oleic acid was the most popular (C18:1), accounting for 90% of monounsaturated fatty acids, in the diet of both the women and men examined. In our study, the percentage share of PUFA among respondents' diet from both groups was insufficient compared to nutritional recommendations.

Linoleic acid supplied 3.37% of the energy value in men and 3.04% in the women's group, which was far from the most recent EFSA nutritional recommendations [9]. Low participation of PUFA in the diet of elderly people was observed in studies by WOBASZ [10], Przysławski et al. [13], Różańska et al. [20], Grochowska-Niedworek [17] and Anyżewska et al. [11]. Low participation of PUFA in the diet of elderly people with cardiovascular disease is a disquieting fact. A correlation between

the consumption of linoleic acid and a decrease of LDL cholesterol concentration, increase of HDL cholesterol and lowering of triglycerides in blood serum were observed [4]. Of all PUFAs, linoleic acid was present in the highest amounts in the diets of the examined persons (C18:2 n-6) and alfa-linoleic acid was second (C18:3 n-3). The proportion of omega-6 to omega-3 acids in the respondents diets was 3:1, which was correct according to the nutritional recommendations of the Polish Forum of Prophylactics of Cardiovascular System Diseases [6]. The consumption of ALA from omega-3 delivered 1% of the energy value of the DNR in the examined group. This fact may be treated as beneficial. The long chain form of fatty acids from the group omega-3, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are synthesized from alfa-linoleic acid. Intervention studies have shown advantageous effects of these acids (consumption on the level of 1 g/day) in the case of high triglyceride concentration, platelet aggregation and high blood pressure [4]. Proper consumption of DHA and EPA were also connected with a diminishing risk of cardiovascular system diseases in epidemiological research by Dybkowska et al. [21].

The participation of cholesterol in the diet of the examined people may be treated as proper (235.71 mg/day in men and 229.04 mg/day in women). In Wolańska's et al. [18] study focusing on the estimation of fat content in the diet of obese and overweight individuals, the consumption of cholesterol was 435mg in the group of men and 324mg among women. But in other studies, the proper share of cholesterol in the nutritional ratios of respondents [10–12, 14, 20] was noted.

The excessive consumption of SFA observed in our research, together with a parallel low supply in PUFA, are basic nutritional mistakes pointed out by nutritionists in Poland [10, 11, 13, 14, 16, 17]. This error is usually the result of overconsumption of products that contain animal fat and under-consumption of products rich in plant fats and seafood. In the examined group, the consumption of products rich in animal fats (particularly among men) was higher than products containing plant fats. Fish consumption was very low (once a month) and a total elimination of the seeds of oily plants, nuts and seafood were observed. This tendency is unfavorable. Similar observations were described in a study by Harton et al. [22] presenting the course of nutrition of elderly men with ischemic heart disease. Moreover, unsatisfactory consumption of plant fats and fish was pointed out in that study. Similar data came from the WOBASZ study [23] that estimated the consumption of nutritional products by the adult population in Poland. According to recommendations from the American Heart Association Nutrition Committee [24] and European research focusing on the prevention of heart disease, fatty sea fish should be consumed at least 1–2 times a week.

The authors concluded that nutritional mistakes described among elderly people suffering from cardiovascular diseases based on arteriosclerosis may have an adverse influence on the course of these diseases and accelerate aging and ultimately decrease the quality of their life.

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